To: California Energy Commission
From: Controlled Energy Corporation
Waitsfield, VT 05673
Date: 11/5/01
Ref: 11/15 and 11/16 Hearings

Greetings:
We are responding to the suggestions made at the 10/22 Workshop to update building energy efficiency standards. Please find a template below that addresses the following suggestions:

1. Develop separate set of requirements for multi-family buildings and reduce the energy trade-off for using a central water heating system rather than individual water heaters in each dwelling unit.
2. Add specific provisions for residential gas instantaneous water heaters
3. Establish minimum efficiency requirements for residential water heaters more stringent than revised federal minimum efficiency requirements.

Description:
The suggestions (1-3) above relate to gas residential tankless (instantaneous) water heaters. This technology is sophisticated and well developed in Europe and Asia, but not well known in the U.S. As shown below, there are many good reasons to consider this type of water heater in energy conscious programs.

Benefits
Owners who install a wall hung instantaneous gas water heater in their dwelling will have full control over energy use. They will only pay for the hot water they use, and in the warm seasons will not have to depend on a centrally heating boiler to provide domestic hot water. When they are not using hot water (95% of any 24 hour period), no energy will be used.
Gas modulating valves assure that energy use is commensurate with hot water use.
Consumers enjoy endless hot water – there is no storage to run out.

Downside
The consumer needs to understand that instantaneous water heaters will provide endless hot water, but not all at once. Some models can provide up to two showers simultaneously (or 2 major applications at a time). Most models provide very satisfactory showers (3 gallons/minute) but laundry or other showers cannot be simultaneous. We have not found this to be a serious detriment – many consumers are already limited by their water pressure to one major application at a time.

Environmental Impact
There are no adverse environmental impacts to instantaneous gas water heaters when compared to other forms of heating water. In fact, an independent engineering study (Richard Heede ’97) showed greenhouse gas emissions are reduced by 50% compared to gas storage tank water heaters. There is no impact on indoor air quality if the unit is

power vented. Water consumption is not increased if the unit is installed near the outlets. Energy consumption is reduced by up to 50% (see below)

Type of Change – Modeling

We presume that such a change would modify calculation procedures, affecting the way trade-offs can be made, but not adding a new compliance requirement.

Measure Availability and Cost

Instantaneous gas water heaters are available in the U.S. through wholesalers, home centers, websites and some plumbers and contractors. Principal manufacturers/suppliers are Bosch AquaStar (6 different models), Takagi (2 models), Paloma (2 models), Infinium (1 model) and others now coming into the marketplace. Currently all Home Depot stores in California stock or special order Bosch AquaStar tankless water heaters. Baseline condition for life cycle cost analysis would be a combination of current standards (DOE labeling, efficiency testing, energy factor determination, life cycle of 15 years).

Controlled Energy Corp has been in business over 20 years, guarantees availability of spare parts and 800 number access.

Initial cost and installation costs generally are twice as much a storage tank water heaters. Payback is estimated (depending on model) to occur in 2-3 years. Savings on energy over the course of 15 years is substantial. Performance verification and commissioning costs are not significant, having already been performed by several laboratories.

Useful Life

Manufacturers claim 20-25 years. Warranties in the U.S. for the Bosch AquaStar are 15 years. Energy savings should persist over the lifetime of the heater because there is no liming over time, hence initial efficiencies are maintained. Maintenance is low although descaling (a simple procedure) may need to be done every 4-6 years depending on the hardness of water.

Performance Verification

Performance verification is done at the time of installation: is the heater functioning, does it modulate, is the water temperature satisfactory, is the venting and air supply sufficient? Some of these relate to comfort and others to efficiency. For example, if venting is not adequate, the unit will not perform satisfactorily and energy savings will not be realized. Furthermore, proper venting is essential, as with any gas appliance.

Cost Effectiveness

Because tankless water heaters are only ‘on’ when hot water is being used, the savings are approximately 30% over natural gas storage tanks, 40% over L.P. and 50% over electric. Cost effectiveness can be determined by computing purchase costs, installation costs, energy usage and maintenance costs over the life of the heater. Savings should be compared similarly, taking into account the decreasing efficiency of the storage tank over time.

Other ‘cost’ considerations are that

1. tankless water heaters weigh 40-60 pounds and are easily strapped to the wall, leading to less danger and loss in earthquake zones
2. Diseases related to bacterial growth in warm water are not a consideration since the water (about a quart) in the heat exchanger is either very hot when in use, or cold.

3. Wall hung gas water heaters are much less prone to being affected by low lying fumes and gases sometimes found in basements or garages
4. No additional purchases are necessary – such as extra insulation blankets, leak detectors, flame guards or platform mounts
5. With no worry about running out of hot water, there is no need to keep the temperature high and then add cold water to 'stretch' the reserve, as one would with a tank. An ideal temperature can be set, eliminating danger of scalding.

Analysis tools

Tools should be utility bills and invoices.

Relationship to Other Measures

N/A

Bibliography and Other Reesearch

Please see Manufacturers' websites:

www.controlledenergy.com
www.takagi-usa.com

These link to research studies and reports (DOE) and background on instantaneous gas residential water heaters. Most 'experts' are affiliated with major institutions and, as such, have not had the occasion to study this technology. Amory Lovins from the Rocky Mountain Institute does know these products. Other sources could include BR Laboratories and South Coast Air Quality Management District.

Thank you for your time in considering the above comments.

Best Regards,

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